Atty. Docket No. PIA31191/ANS/US-KY
Application No: 10/765,027

Remarks

Applicant and his representatives wish to thank Examiner Novacek for the detailed Office Action dated April 24, 2006. Claim 12 has been canceled. Independent Claims 1 and 8 have been amended to include the limitations of Claim 12.

The present invention relates to a method for manufacturing a MOSFET device that includes forming a first oxide layer on a surface of an active region of the substrate and implanting ions thereinto for forming an LDD (Lightly Doped Drain) before defining a gate region. A part of a first nitride layer is removed, then the LDD and the substrate underneath are etched to define a gate region. For example, a part of a first nitride layer and oxide layer are removed, then the LDD and underlying substrate are etched by a depth of about 200 to about 1000 Å to define a gate region (see, e.g., Claim 1). Further, ions are implanted into the substrate to form a source and drain at locations deeper than that of the LDD after the substrate is etched to define the gate region (see Figure 1H, parts 28 and 30). It is believed that forming the source and drain at the locations deeper than that of the LDD enables stable control of a threshold voltage, therefore making it easier to form an ultra shallow junction.

The cited references do not suggest, alone or taken together, implanting ions into a substrate to form a source and drain at locations which are deeper than that of a lightly doped drain and at sides of a gate.

The Rejection of Claims 1-3, 6, 7, 10, and 11 under 35 U.S.C. § 103(a)

The rejection of Claims 1-3, 6, 7, 10, and 11 under 35 U.S.C. § 103(a) as being unpatentable over Li et al. (U.S. 6,309,933) in view of Yagashita et al. (U.S. 6,607,952 [hereinafter "Yagashita"]) and Wu (U.S. 5,817,558) is respectfully traversed.

Li et al. discloses an angled LDD ion implantation after a gate is formed (see column 5, ll. 56-57). Further, Li et al. discloses forming a source/drain area above the LDD area (see Figure 14, part 68). It is believed that Li et al. does not disclose selectively forming a shallow

trench isolation in a substrate or forming a source/drain area at a location deeper than that of the LDD.

Yagashita discloses a method of manufacturing a semiconductor device comprising a trench formed in an element isolation region surface of a substrate. It is believed that Yagashita does not disclose removing part of the LDD formed in the active region to form a gate, or forming a source/drain region at a location deeper than that of the LDD.

Thus, the combination of Li and Yagashita is deficient with regard to forming a source/drain region deeper than an LDD. Wu fails to cure these deficiencies.

Wu discloses forming a lightly doped source and drain by implanting ions into an active region (see column 2, ll. 45-47, column 3, ll. 11-13, and Figure 2). Further, Wu appears to disclose that the ions may be implanted into the active region prior to etching a substrate to form a gate depression region. However, it is believed that Wu fails to teach or suggest implanting ions into the substrate to form a source and drain at locations deeper than that of the LDD and at a position to the side of the gates. Thus, Wu doe not appear to cure the deficiency of Li and Yagashita with regard to the present claims.

It is also believed that Wu forms the source/drain area on the LDD, which is believed to result in junction characteristics that are distinct from the present invention. Wu appears to disclose high voltage elements. In contrast, the method of Claims 1 and 8 are applicable to lower voltage devices.

It is believed that the cited references, alone or taken together, do not render Claims 1 and 8 obvious because implanting ions into the substrate to form a source and drain at locations which are deeper than that of the LDD and at sides of the gate is not disclosed by any of the cites references. As a result, the rejection of Claim 1 under 35 U.S.C. § 103(a) should be withdrawn.

Claims 2-3, 6, and 7 depend from Claim 1, and thus include all of the limitations of Claim 1. Claims 10 and 11 depend from Claim 8, and thus include all the limitations of Claim 8. Therefore, Claims 2-3, 6-7, and 10-11 are patentable over Li et al. in view of Yagashita et al. and Wu for essentially the same reasons as Claims 1 and 8.

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The Rejection of Claim 5 under 35 U.S.C. § 103(a)

The rejection of Claim 5 under 35 U.S.C. § 103(a) as being unpatentable over Li et al. in view of Yagashita et al. and Wu and further in view of Bovaird et al. (U.S. 4,830,975 [hereinafter "Bovaird"]) is respectfully traversed.

Claim 5 depends from Claim 1, and thus includes all of the limitations of Claim 1. As explained above, the combination of Li, Yagashita, and Wu is deficient with regard to Claim 1. Bovaird fails to cure this deficiency.

It is believed that Bovaird fails to teach or suggest implanting ions into the substrate to form a source and drain at locations which are deeper than that of the lightly doped drain and at sides of the gates. As a result, it is believed that Bovaird does not cure the deficiency of Li et al, Yagashita, and Wu.

Therefore, Claim 5 is believed to be patentable over Li et al. in view of Yagashita and Wu, and further in view of Bovaird for essentially the same reasons as Claim 1. Consequently, the rejection of Claim 5 under 35 U.S.C. § 103(a) should be withdrawn.

The Rejection of Claims 8, 9, and 13-19 under 35 U.S.C. § 103(a)

The rejection of Claims 8, 9, and 13-19 under 35 U.S.C. § 103(a) as being unpatentable over Li et al. (U.S. 6,309,933) in view of Wu (U.S. 5,817,558) is respectfully traversed.

As discussed above, it is believed that Li et al. and Wu both fail to teach or suggest implanting ions into the substrate to form a source and drain at locations which are deeper than that of the LDD and at sides of the gates as stated in Claim 8. As a result, the rejection of Claim 8 under 35 U.S.C. § 103(a) should be withdrawn.

Claims 9 and 13-19 depend from Claim 8, and thus include all of the limitations of Claim 8. Therefore, Claims 9 and 13-19 are patentable over Li et al. in view of Wu for essentially the same reasons as Claim 8.

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The Rejection of Claim 12 under 35 U.S.C. § 103(a)

The rejection of Claim 12 under 35 U.S.C. § 103(a) as being unpatentable over Li et al. in view of Wu and further in view of Bovaird is now moot since Claim 12 has been canceled.

Conclusions

In view of the above amendments and remarks, all bases for objection and rejection are believed to be overcome, and the application is believed to be in condition for allowance. Early notice to that effect is earnestly requested.

Respectfully submitted,

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